

CLAIMS

1. A method of computing a linearity profile to compensate for scan line velocity nonlinearity in an electrophotographic device comprising:

- 5 obtaining a plurality of laser beam position measurements;
- 10 assigning a first insertion time;
- assigning a second insertion time; and
- performing for a plurality of Pel locations along a laser beam scan path:
- determining an ideal Pel location based upon a desired correction resolution;
- computing a first postulated position based upon said first insertion time and select ones of said plurality of measurements;
- computing a second postulated position based upon said second insertion time and select ones of said plurality of measurements; and
- 15 storing a correction value corresponding to a select one of said first and second postulated positions that is closest to said ideal Pel location.

2. The method according to claim 1, wherein said plurality of laser beam position measurements comprise a plurality of test points that measure for each test point, a scan direction position and a corresponding time value.

20 3. The method according to claim 2, wherein each corresponding time value is expressed as a function of an angle of a rotating polygonal mirror in a corresponding printhead.

- 25 4. The method according to claim 3, wherein:
- said first postulated position is computed based upon a rotational velocity of said rotating polygonal mirror and said first insertion time to derive a first postulated angle;
- said second postulated position is computed based upon said rotational velocity of said rotating polygonal mirror and said second insertion time to derive a second postulated angle; and
- 30 for each of said first and second postulated angles:

identifying an upper bound as a select one of said plurality of test points having an angle greater than said corresponding first or second postulated angle;

5 identifying a lower bound as a select one of said plurality of test points having an angle less than said first or second postulated angle; and
interpolating said corresponding first or second postulated position based upon said associated upper and lower bounds.

- 10 5. The method according to claim 4, wherein said interpolation comprises a linear interpolation.
- 15 6. The method according to claim 4, wherein said upper bound is a select one of said plurality of test points having an angle closest to and greater than said corresponding first or second postulated angle and said lower bound is a select one of said plurality of test points having an angle closest to and less than said corresponding first or second postulated angle.
- 20 7. The method according to claim 4, further comprising an accumulated angle, wherein said accumulated angle is initialized to a starting angle and is updated by adding to said accumulated angle, a select one of said first and second postulated angles corresponding to said first and second postulated positions that is closest to said ideal Pel location.
- 25 8. The method according to claim 3, wherein said plurality of laser beam position measurements are modified based upon registration data.
9. The method according to claim 8, wherein said registration data comprises a margin adjustment, said margin adjustment computed by rotating said laser beam position measurements such that each scan direction measurement is modified and corresponding ones of said angle measurements are unchanged.

10. The method according to claim 1, wherein a select one of said first and second postulated positions is chosen as being closest to said ideal Pel location by:

computing an absolute error of said first postulated position relative to said ideal Pel location,

5 computing an absolute error of said second postulated position relative to said ideal Pel location, and

choosing a select one of said first and second postulated positions with the smallest absolute error.

10 11. The method according to claim 1, wherein said ideal Pel location is based upon previously accumulated ideal Pel location position.

12. The method according to claim 11, wherein said ideal Pel location is based upon an initial ideal Pel location corresponding to a location of a first written Pel associated with
15 a printed page.

13. The method according to claim 1, wherein said first and second insertion times each correspond to a respective offset from a nominal value.

20 14. The method according to claim 1, wherein said correction value indicates whether a Pel clock should be based upon said first insertion time or said second insertion time.

15. The method according to claim 1, wherein a print resolution is different from said desired correction resolution, and said linearity profile is scaled to said print resolution.

25 16. A method of computing a linearity profile to compensate for scan line velocity nonlinearity in an electrophotographic device comprising:

obtaining a plurality of laser beam position measurement comprising a plurality of test points that measure for each test point, a scan direction position and a corresponding time value;

30 initializing an accumulated angle;

computing an initial scan direction position based upon said starting accumulated angle;

assigning a first insertion time;

assigning a second insertion time; and

5 performing for a plurality of Pel locations along a laser beam scan path:

determining an ideal scan direction Pel location based upon a predetermined correction resolution;

computing a first postulated angle based upon said first insertion time and said accumulated angle;

10 converting said first postulated angle to a first postulated position based upon select ones of said plurality of measurements;

computing a second postulated angle based upon said second insertion time and said accumulated angle;

converting said second postulated angle to a second postulated position based upon select ones of said plurality of measurements;

15 comparing said ideal scan direction Pel location to said first and second postulated positions;

storing a correction value corresponding to a select one of said first and second postulated positions that is minimizes an error computation relative to said ideal scan direction Pel location; and

20 updating said accumulated angle to said first postulated angle if said first postulated position results in less error than said second postulated position, and updating said accumulated angle to said second postulated angle if said second postulated position results in less error than said first postulated position.

25 17. The method according to claim 16, wherein said starting accumulated angle is determined based upon a predetermined time from detecting a start of scan signal.

30 18. The method according to claim 16, wherein said starting accumulated angle is based upon a nominally stored value and an offset value.

19. The method according to claim 18, wherein said starting accumulated angle is computed based upon a motor velocity of a rotating polygonal mirror.
- 5 20. The method according to claim 16, wherein a correction value is computed for every writable Pel location based upon said correction resolution.
- 10 21. A laser beam scan line velocity linearity registration system comprising:
 - a slice clock operatively configured to output slice clock pulses having a fixed frequency;
 - 15 a pel clock generator programmably configured to generate pel clock pulses based upon said slice clock pulses and correction values input thereto;
 - a pel clock counter communicably coupled to said pel clock generator, said pel clock counter operatively configured to determine a count value corresponding to a count of pel clock pulses;
 - 20 a linearity table having stored therein, a plurality of correction values, said linearity table communicably coupled to said pel clock counter and said pel clock generator such that an associated one of said correction values is selected from said linearity table based upon said count value from said pel clock counter and is communicated to said pel clock generator, wherein a duration of a corresponding pel clock pulse is determined from said correction value; and
 - 25 a video unit arranged to communicate Pels to a corresponding laser beam, said video unit coupled to said slice clock and said pel clock, wherein a duration of each Pel is determined by said slice clock, and spacing between Pels is determined by said pel clock.
22. The system according to claim 21, wherein said pel clock counter is reset before each scan line write of a corresponding laser beam.
- 30 23. The system according to claim 21, wherein the duration of each pel comprises at least one slice clock pulse.

24. The system according to claim 21, wherein said pel clock generator corresponds each correction value supplied from said linearity table thereto, to an associated number of slice clock pulses to derive a corresponding pel clock pulse.
- 5 25. The system according to claim 21, further comprising:
 - a first count register having stored therein, a first count value; and
 - a second count register having stored therein, a second count value, wherein each correction value from said linearity table is used to select between said first and second count registers, which are used to determine the number of slice clock pulses in a corresponding pel clock pulse.
- 10 26. The system according to claim 25, wherein each of said first and second count values define an offset from a base slice clock pulse count.
- 15 27. The system according to claim 26, wherein said pel clock generator generates a pel clock pulse at a nominal rate when no correction value is communicated from said linearity table, and said pel clock generator generates a pel clock pulse based upon said nominal rate and a select one of said first and second count values when a correction value is communicated from said linearity table.
- 20 28. The system according to claim 25, wherein each correction value in said linearity table comprises a one-bit value that is used to select either said first or second count registers.
- 25 29. The system according to claim 21, wherein a first pel clock pulse for a given scan line occurs at a predetermined number of slice clock pulses after a start of scan signal is detected.
- 30 30. The system according to claim 28, wherein said predetermined number is modified by a random value at the start of each scan line.

31. The system according to claim 21, further comprising an insertion rate divisor between said pel clock generator and said counter, configured to update said counter based upon integer multiples of pel clock pulses.
- 5 32. The system according to claim 21, wherein said correction values are stored in said linearity table based upon a predetermined resolution of printing, wherein said pel clock counter compensates for relatively higher print resolutions by modifying when said count value is updated.